

## Proximal and distal Facial nerve exploration during superficial parotidectomy

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**Abstract** One of the most technique sensitive surgeries in the maxillofacial region is the parotid gland surgery owing to the close relation between the gland and the extra-cranial course of facial nerve. Facial nerve is generally located by means of a proximal surgical identification technique aimed at identifying the facial nerve at its point of exit from the stylomastoid foramen to its entry into the posteromedial surface of parotid gland. There are reports in the literature on distal nerve identification techniques, either as a choice or in cases where proximal nerve identification is difficult. The present report deals with personal clinical experience, describing both the techniques for detection of the facial nerve in 17 cases reported. The technique mainly chosen was conventional proximal nerve identification technique in 16 cases. Distal exploration of the buccal branch was undertaken only in one case, on account of difficulty in locating the main trunk intraoperatively, due to the presence of a post inflammatory fibrosis. The decision to resort to the identification of the buccal nerve is supported by the regular course and adequate size of this branch of facial nerve in its peripheral area co-located with stenson's duct, which enable it to be easily identified during surgery.

**Keywords** Facial nerve · Parotidectomy · Proximal · Distal

### Introduction

Parotid gland surgery is technique sensitive because of the close relationship of the gland with the extra-cranial facial nerve which is a motor supply to the muscles of facial expression. Whether the condition is benign or malignant and if the facial nerve is not involved preoperatively, its preservation is important for both aesthetic and functional outcome of the surgery. The most frequent morphology of the facial nerve is reported, in the literature [1–3], to be dichotomous, with cervicofacial and temporofacial divisions further dividing into temporal, zygomatic, buccal, marginal mandibularis and cervical branches. The superior temporofacial branch runs upwards and medially and is generally larger. The anatomical evaluations reveal that all the five branches run in the substance of parotid isthmus dividing superficial and deep lobes of the parotid. They are covered by glandular acini and rests on the aponeurosis of the masseter muscle, with its temporal and zygomatic component running to a thin adipose layer upon its emergency from the cranial pole of the gland. Facial nerve is identified by means of proximal surgical technique aimed at isolating proximally the main nerve trunk anywhere between stylomastoid foramen and parotid gland entry. There are four anatomical landmarks leading to the identification of the trunk of the facial nerve as it leaves the stylomastoid foramen: (a) The cartilaginous external auditory meatus forms a 'pointer' at its anterior inferior border indicating the direction of the nerve trunk. (b) Just deep to the cartilaginous pointer is a reliable bony landmark formed by the curve of the bony external meatus and its abutment with the mastoid process. This forms a palpable groove leading directly to the stylomastoid foramen. Unfortunately this groove is filled with fibrofatty lobules that often mimic the trunk of the facial nerve which can lie

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as much as 1 cm deep to this landmark. (c) The anterior, superior aspect of the posterior belly of the digastric muscle is inserted just behind the stylomastoid foramen. (d) The styloid process itself can be palpated superficial to the stylomastoid foramen and just superior to it. The nerve is always lateral to this plane and passes obliquely across the styloid process. A branch of the postauricular artery is usually encountered just lateral to the nerve. Distal nerve identification techniques are rarely described in the literature, these being adapted, as necessary, by the surgeon, depending on the localisation of the neoplasm, and approach the isolation of the nerve beginning from any of its peripheral branches [4].

### Materials and Methods (Table 1)

Aim of the present investigation is to analyse our 17 surgical case reports, with particular attention being focused on that case in which it was necessary to resort to retrograde identification of the buccal branch of the facial nerve due to post inflammatory fibrosis. The study population comprised 16 females and one male, from 27 to 76 years of age. In none of the cases a operative microscope was used

or electrophysiological monitoring of facial nerve was undertaken.

### Surgical Technique

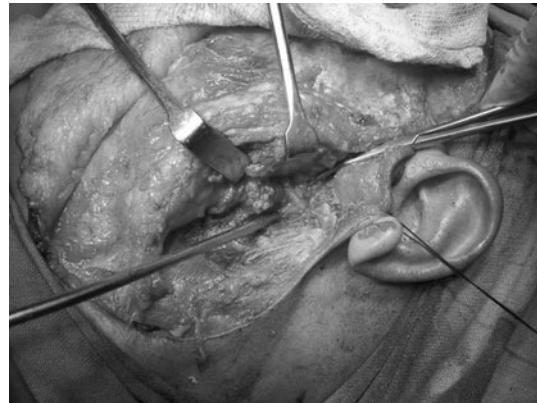
Whenever the medical condition allows and the patient is fit, hypotensive anaesthesia is used, as this considerably reduces oozing and thus makes it easier to trace the facial nerve fibres. The modified Blair's incision line is marked (Fig. 1) and infiltrated with lignocaine hydrochloride and 1:80,000 adrenaline and the incision is made with a Colorado microdissection needle. The skin flap is raised in the plane of the parotid fascia (Fig. 2). Blood free plane anterior to the external auditory meatus which leads the surgeon down to the base of skull just superficial to the styloid process and the stylomastoid foramen is then gently opened up in an inferior direction by blunt dissection until the trunk of the facial nerve is seen but is generally misleading and is not our choice of entry in the region. We identify the posterior belly of the digastric muscle in the cervical extension of the incision. The anterior border of the sternocleidomastoid muscle is mobilized and retracted inferiorly to display the posterior belly of digastric muscle beneath it. This manoeuvre necessitates sectioning the

**Table 1** Clinical cases in which superficial parotidectomy were carried out

S. no	Age (years)/sex	Pathology	Approach used for superficial parotidectomy	Functional recovery after 6 months
1.	47/F	Pleomorphic adenoma	Proximal nerve exploration	Complete
2	27/F	Lymphoepithelial cysts	Proximal nerve exploration	Complete
3	63/F	Acinic cell carcinoma	Proximal nerve exploration	Deficit along the distribution of temporal and zygomatic branches
4	62/F	Mucoepidermoid carcinoma	Proximal nerve exploration	Complete
5	76/M	Kuttner's tumour	Distal nerve exploration	Complete
6	50/F	Acinic cell carcinoma	Proximal nerve exploration	Complete
7	64/F	Neurofibroma facial nerve	Proximal nerve exploration	Paralysis along the distribution of buccal and marginal mandibularis
8	72/F	Pleomorphic adenoma	Proximal nerve exploration	Complete
9	48/F	Pleomorphic adenoma	Proximal nerve exploration	Complete
10	45/F	Oncocytoma	Proximal nerve exploration	Deficit along the distribution of marginal mandibularis
11	63/F	Pleomorphic adenoma	Proximal nerve exploration	Deficit along the distribution of buccal and marginal mandibularis
12	70/F	Acinic cell carcinoma	Proximal nerve exploration	Complete
13	65/F	Pleomorphic adenoma	Proximal nerve exploration	Complete
14	66/F	Acinic cell carcinoma	Proximal nerve exploration	Deficit along the distribution of marginal mandibularis
15	58/F	Pleomorphic adenoma	Proximal nerve exploration	Complete
16	48/F	Squamous cell carcinoma scalp with intraparotid metastasis	Proximal nerve exploration	Complete
17	60/F	Pleomorphic adenoma	Proximal nerve exploration	Complete



**Fig. 1** Marking of modified Blairs incision



**Fig. 3** Exploration of proximal facial nerve main trunk

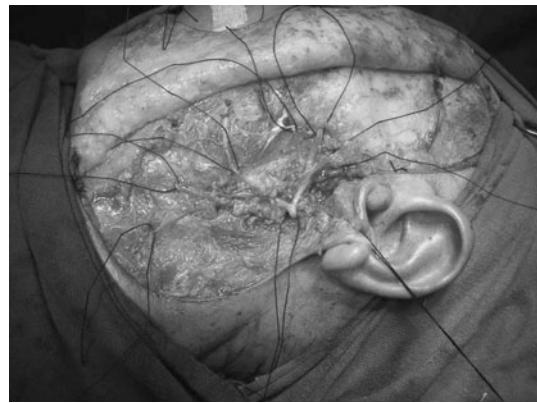


**Fig. 2** Dissection of parotid fascia upto stensons duct



**Fig. 4** Dissection of upper and lower division of facial nerve

great auricular nerve. The posterior belly of the digastric is traced upwards and backwards to its insertion onto the mastoid which lies immediately below the stylomastoid thus leading the operator to the facial nerve from below (Fig. 3). Once the facial nerve trunk is identified the superficial lobe of the parotid can be ‘exteriorized’ by opening up to plane in which the branches of the facial nerve run between the two lobes by blunt dissection (Fig. 4). Initially, as it leaves the stylomastoid foramen, the trunk of the facial nerve turns abruptly to become more superficial and also divides into the larger zygomaticofacial trunk smaller cervicofacial trunk. The five main branches of the nerve are then followed peripherally through the parotid until the superficial lobe is completely freed (Fig. 5). This part of the operation is performed using fine scissors, opened up in the plane of the facial nerve branches, with care always taken to identify the nerve fibre before dividing parotid tissue. During the lower part of the dissection, branches of the posterior facial vein will be encountered immediately deep to the marginal mandibular branch. Great care is taken when vascular clamps are



**Fig. 5** Branching of facial nerve exposed following superficial parotidectomy

applied to these branches to avoid damaging the facial nerve. If the superficial parotidectomy is being performed for chronic infection, the duct is tied off as far ahead to prevent recurrent ascending infection from the oral cavity



**Fig. 6** Distal facial nerve exposure (buccal branch)



**Fig. 7** Wound closed in layers with vacuum drain in situ

(Fig. 6). Rarely after recurrent infection and fibrosis or previous radiotherapy the trunk of facial nerve is difficult to be identified using conventional technique. In this situation nerve is identified at the anterior border of the parotid and traced centrally towards the stylomastoid foramen. In the distal nerve exploration method we first identified the buccal branch of the facial nerve about 4 cm anterior to the tragus along the ala-tragal line (Fig. 6). This branch is dissected in a retrograde fashion as far as the main trunk of the facial nerve. The remaining branches of the facial nerve are dissected in an anterograde fashion, displacing the parotid gland superiorly and inferiorly. Following removal of the parotid gland the blood pressure is returned to normal, all bleeding points are controlled, a vacuum drain placed and the wound closed in layers (Fig. 7).

## Results

Epithelial benign parotid neoplasm was the most frequent finding, i.e., 8/17 cases, representing 48%. With regard to malignant neoplasms, there were 5 primary epithelial

**Table 2** Complications

Complication	Numbers
Temporary dysfunction of the facial nerve	04
Permanent dysfunction of the facial nerve	01
Frey syndrome	01
Haematoma	—
Wound infection	—
Hypertrophic scar	—
Salivary fistula	—
Sialocele	02

tumours of the parotid. The other malignant neoplastic conditions included one case of intraparotid lymph node metastases from carcinoma scalp. The study also comprised one case of Kuttner's tumour. Superficial parotidectomies were also performed for one case each of lymphoepithelial cysts and intraparotid facial nerve neurofibroma. Overall 17 superficial parotidectomies were performed. In 16/17 cases, 94% of the procedures, the extra-cranial facial nerve was located by means of proximal nerve identification technique (Table 1). Though there was no motor deficit in the case where distal nerve exploration was done, functional outcome of the surgery cannot be compared. Permanent facial nerve dysfunction was found only in one case (Table 2).

## Discussion

The classic approach to facial nerve requires four anatomical landmarks leading to the identification of the trunk of the facial nerve as it leaves the stylomastoid foramen which are: (a) The cartilaginous external auditory meatus forms a 'pointer' at its anterior inferior border indicating the direction of the nerve trunk. (b) Just deep to the cartilaginous pointer is a reliable bony landmark formed by the curve of the bony external meatus and its abutment with the mastoid process. This forms a palpable groove leading directly to the stylomastoid foramen. Unfortunately this groove is filled with fibrofatty lobules that often mimic the trunk of the facial nerve which can lie as much as 1 cm deep to this landmark. (c) The anterior, superior aspect of the posterior belly of the digastric muscle is inserted just behind the stylomastoid foramen. (d) The styloid process itself can be palpated superficial to the stylomastoid foramen and just superior to it. The nerve is always lateral to this plane and passes oblique across the styloid process. A branch of the postauricular artery is usually encountered just lateral to the nerve. This technique is most frequently used and generally held to be the safest for anatomical and functional nerve preservation. Satisfactory results are obtained after partial

or total conservative parotidectomy procedures with proximal nerve identification technique, in which the percentage of permanent nerve paralysis is less than 1–2% in cases of benign pathologies [5–8], while the rate of temporary deficits ranges from 20–55% [9–11]. In a very few cases, the proximal approach to facial nerve is extremely difficult, even with the use of an operative microscope and with intraoperative monitoring of the facial nerve, and it is, therefore, necessary to use the distal nerve localisation technique. The technique of identifying the facial nerve by means of the isolation of its peripheral branches has been codified for years: in the 1980s, even Work and Bailey presented several examples of the retrograde approach from the buccal, mandibular and temporal rami in those cases in which they reach the surface of the parotid gland. These authors recommend following the deep parotid vein as reference for the mandibular rami, which cross it laterally [4]. In our opinion, distal nerve exploration should not be the approach of choice and cannot be decided preoperatively, but only when proximal nerve isolation is found to be extremely difficult intraoperatively this method can be employed. In our case, after the preparation of the skin flap, dissection in the parotid region was found difficult due to fibrosis, because of recurrent parotid and periparotid inflammation preoperatively. In our opinion identification of the buccal nerve is supported by the regular course and adequate size of this branch facial branch in its peripheral area co-located with stenson's duct, which enable it to be easily identified. Intraoperative monitoring of facial nerve function, using electromyographical techniques is proposed in parotid surgery to identify the principal nerve trunk and its peripheral branches in complex cases or during retrograde approaches [12–14]. Following parotidectomy employing facial nerve monitoring, Terrell et al. [15] achieved a low percentage of early postoperative facial nerve paralysis in the group monitored, albeit there was no significant statistical difference in long-term nerve function; Witt [11], on the other hand, demonstrated a high rate of facial paralysis in a group monitored during superficial parotidectomy, concluding that electrophysiological monitoring is optional and must not be considered a standard technique in such surgery. The validity of facial nerve monitoring can play an important and advantageous part in the surgical treatment of recurrent parotid neoplasms [12, 15]. Facial nerve monitoring along with distal nerve exposure is well supported in literature [16].

## Conclusion

Our opinion, the main point of reference in the isolation of the facial nerve is the posterior belly of the digastric muscle; when, however, proximal nerve exploration is

difficult, isolation of the nerve via the distal nerve exploration from the buccal branch can be carried out [17, 18].

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